Fraunhofer USA

Fraunhofer USA:

Coatings and Laser Applications Michigan (CCL)

Experimental Software Engineering, Maryland (CESE)

Laser Technology Michigan (CLT)

Manufacturing & Advanced Materials, Delaware (CMAM)

Manufacturing Innovation, Massachusetts (CMI)

Molecular Biotechnology, Delaware (CMB)

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Fraunhofer USA celebrates 10th anniversary!

Who would have thought that the 3 person office started in 1994 would grow to a multi-state, multi-operational enterprise with ties to major universities, government agencies and impressive industrial partners ten years later?

That is just what Fraunhofer USA did.

The mission of Fraunhofer USA has always been to provide our customers with world-class technology solutions to help our customers challenge their competition. Fraunhofer provides technological solutions which can be implemented immediately on the factory floor and not merely consulting on how to proceed. We continue to serve market-driven technology needs and promote international cooperation in business. Markets have changed, our vision has not.

Over the years, we have seen many advances in science with Fraunhofer taking the lead. Our scientists and engineers are leaders in their field presenting technical papers to colleagues all over the world.

As in Germany, Fraunhofer USA offers engineering students and recent graduates the opportunity to acquire further qualifications and hands-on experience while they complete dissertation research or do a practical internship.

Fraunhofer has expanded and contracted in keeping with the economy. Over the years we created research centers where the technology was most needed, and later re-directed those efforts to other emerging technologies. Our industrial partners have aided in the transition of several of these situations to the benefit of both parties.

Several of the Fraunhofer research centers have spun-off for-profit companies; kSARIA, Inc., Visotek, Inc., AthenaBio, Inc. and Boston Array. These companies have commercialized the many technologies developed at Fraunhofer.

With ten years under its belt, Fraunhofer has built up an impressive customer base and formed alliances with some of the most important companies and universities in the U.S. We have taken part in fascinating governmental projects such as NASA's space shuttle program as well as projects within the Department of Defense and Homeland Security. From diode lasers to anthrax vaccine, coil winding machines to award-winning coating processes, whatever technology needs presented by our customers, Fraunhofer provides the answer. Up-to-the minute results backed by world-renowned experts -- that's the Fraunhofer way.

Thanks for helping us achieve this milestone!

The Fraunhofer USA building, Plymouth, Michigan

CMB Creates Safe and Potent Anthrax Vaccine

CMB has entered into a cooperative research development agreement (CRADA) with the United States Navy and NuCycle Therapy, Inc. Together, they will carry out a phase I human clinical trial to test a plant-derived, safe oral anthrax vaccine. The work will be a team effort between the Fraunhofer Center for Molecular Biotechnology, the Naval Medical Research Center and NuCycle Therapy, Inc.

The goal of this project is to create a safe and potent vaccine to protect civilian and military personnel from anthrax, which is often linked to global terrorist activities. The oral vaccine is plant-based and edible which minimizes the need for mass injectible immunizations and the risks inherent in that exercise. The injected anthrax vaccine has been blamed for illness in hundreds of U.S. troops over the past decade in connection with the controversial "Gulf War Syndrome."

The injected anthrax vaccine is made from growing and harvesting anthrax bacteria, a process that produces toxins. CMB can make very effective vaccines that are much safer. Oral vaccines are self-administered, enabling large groups of people to be treated quickly in case of a bioterror attack. In addition to being safer, plant-derived vaccines are easier to stockpile. Plant-based vaccines can be either oral or injectible.

To produce the new oral vaccine, a genetically modified plant virus is put into a plant causing the plant to make new proteins. When the plant is eaten, the body reacts to the new proteins as if infected and creates antibodies against the bacteria. The original plant virus is not an active ingredient in the vaccine and the vaccine is non-toxic. It has been successfully tested on animals with human trials at the naval medical center expected to begin in 2005.

The technique, pioneered by CMB, may offer huge cost savings to drug manufacturers because it does not require building fermentation plants which cost over $200 million.

CMB's announcement was featured in the Sept. 25, 2004 Delaware Online Journal in an article by Richard Sine. The complete article can be found online at: http://www.delawareonline.com/newsjournal/business/2004/09/25navytotestorala.html.

CCL Ignites Interest at IMTS 2004 Chicago

Fraunhofer Center for Coatings and Laser Applications participated in the 2004 International Manufacturing Technology Show (IMTS) in Chicago. CCL showcased its latest coating and laser technology developments for the manufacturing industry at this trade show which attracted more than 86,000 visitors.

CCL presented its coating technology offering improved performance in wear resistance, increased productivity and cost savings.

Also presented was CCL's Laser Arco® technology used to deposit the Diamond Like Carbon coating Diamor®, as well as other high performance film systems utilized by coating equipment manufacturers and users of industrial coatings. Aerospace, defense, tooling and biomedical industries are attracted to the properties of the smooth coatings achieved with this technology and that these coatings can be deposited at room temperature, allowing the coating of temperature sensitive materials. This technology was acquired from CCL's partner institute IWS in Dresden.

On display were examples of CCL's laser projects including laser cladding for oil drilling components and laser hardening for localized wear resistance on automotive power-train components. Also featured was the latest laser welding technology for joining advanced high strength steels, high carbon steels, cast iron and aluminium. The Center's new laser brazing capability for automotive body-in-white joining was also showcased for the first time.

MELATO®, the rapid prototyping technology for fast manufacturing of complex formed tools, generated serious interest. Three dimensional CAD data is modified, sliced and distributed across a sheet panel. The cross sections are cut out with a laser beam and then joined using form-closed and force-closed assembly. Various bonding methods such as brazing, clamping and laser beam welding ensure high flexibility of the manufacturing process and convenient modification of the tools. Target applications include injection molding tools with conformal cooling systems and metal sheet forming tools. MELATO® is also from Fraunhofer IWS.

The promising contacts made at IMTS 2004 will be pioneering tomorrow's coating and laser technology, with Fraunhofer CCL as their research and development partner.

CCL booth at the IMTS Show, Chicago

Cooperation Project Unites German and American Software Expertise

CESE and its partner institute, IESE in Kaiserslautern Germany, conduct applied research in software engineering on similar topics. Since each of the research projects had different customer needs and goals, the knowledge gained has also been different, but strongly related. In order to leverage expertise and utilize assets as much as possible, the two organizations have begun a cooperation project funded by Fraunhofer Gesellschaft to align and integrate competencies.

The foundation of the cooperation project is the integration of two well-established technology areas into one unified model: Quality Assurance (QA) (including inspection and testing techniques) and Software Product Lines (SPL) (including architecture and reverse engineering) under the theme of "dependable software engineering" (DSE). Beyond the important task of sharing knowledge by integrating and enhancing existing technologies, the cooperation project will produce concrete deliverables that will set the basis for future common activities:

- Define a methodology to support IESE and CESE personnel in designing and analyzing SPL architectures for clients and in deciding what QA techniques to apply to client organizations. The method will take clients' goals and organizational profiles into account and will be based on previous experience gained from applying existing technologies.

- Produce a shared tool platform, which will enable research and project tools to be used together. The first step is to define a common architecture, including programming guidelines on building tool plug-ins, and then to port the first tools to the infrastructure. The goal is to integrate measurement, reverse engineering, and software architecture tools, as well as tools to support quality assurance.

A unified Inspection Technique is one of the first QA techniques being packaged in this way. CESE and IESE have begun by defining the discrete components of a unified service offering:

- A common template used to define inspection procedures ("reading techniques") for customers;
- A process for tailoring the instantiated procedures to a given team;
- A start-to-finish method that describes how Fraunhofer personnel should work with customers to tailor and train the procedures;
- A set of requirements for tool support that can be used to assist the interaction between Fraunhofer personnel and customers.

Over the next year, CESE and IESE will be turning these concepts into reality.

NASA Award

NASA Award for "Best New Research" for CESE-supported Technology Infusion Project

The NASA Office of Safety and Mission Assurance's Software Assurance Research Program recognized the Software Engineering Researcher/ Developer Collaborations technology infusion project with an award for "Best New Research". CESE and members of the United Space Alliance in Houston were key contributors to the success of this project which involved designing and applying tailored perspectives for software inspections in the development of Shuttle support software.

Fraunhofer CMI Develops Tool to Aid in Medical Diagnostics

CMI is developing a low-cost, massively parallel cell analysis and sorting (MPCAS) device based on MEMS (micro-electro-mechanical systems) technology. This tool will aid the medical research community by offering a reliable, low-cost alternative to conventional flow cytometry.

Flow cytometry is based upon electrostatic deflection of charged droplets similar to that used in ink-jet printers. This technique was first introduced to the research community more than 30 years ago, and it has been widely applied in many areas of life science research, serving as a critical tool for those working in fields such as genetics, immunology, molecular biology, and environmental sciences. However, conventional flow cytometers are costly ($250,000), mechanically complex, and require trained personnel for operation and maintenance. Consequently, high-performance flow cytometers are beyond the reach of the individual researcher, and is usually utilized as a shared-resource in large research institution.

Microchip based assays have the potential to revolutionize the study of disease. Microfabrication permits integration of cell sorting with other technologies such as Polymerase Chain Reaction (PCR), DNA analysis, electrolysis, and allows for novel sorting algorithms that are not possible in conventional cell sorters. In addition, multiple cell sorters can be fabricated in parallel on a single chip, allowing increased throughput or successive enrichments of a sample. These devices can greatly facilitate screening of combinatorial chemistry libraries or cell populations during in-vitro molecular evolution, with even broader applications in the drug-discovery and blood analysis fields.

The MPCAS chip under development will perform the following functions:

- Rapid individual cell capture
- Optical cell identification

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based on conventional labeling techniques

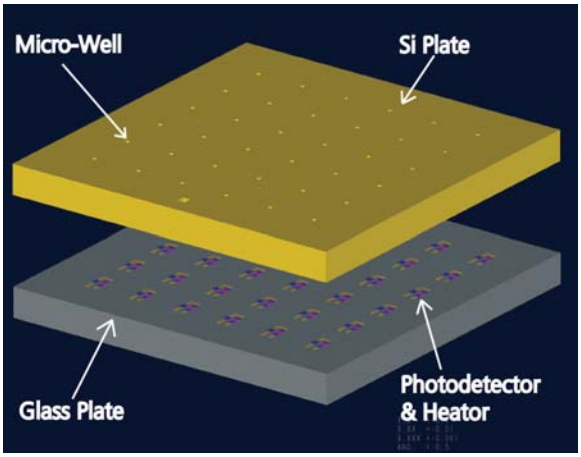
- Cell analysis through fluorescence
- Rapid cell separation
- Routing for additional biochemical processing

The device is comprised of two bonded plates. The upper silicon plate contains an array of micro-wells with dimensions comparable to the size of the cell; the lower Pyrex glass plate comprises an array of micro-heaters. The chip is packaged in a flow chamber for loading. Cells are captured in the array of micro-wells through suction, and a focused laser beam scans across the entire array. Individual cells will be retained or ejected based on fluorescence intensity and electrical bias level, resulting in highly efficient parallel identification and sorting of cells. The micro-heater at any individual site can be activated, forming vapor bubbles which propel the trapped cell out of the micro-well. These cells can be discarded, maintaining only the cells of interest trapped in the micro-wells, or, conversely, the ejected cells can be the cells of interest being routed for down stream processing.

The advantages of the MPCAS chip platform include:

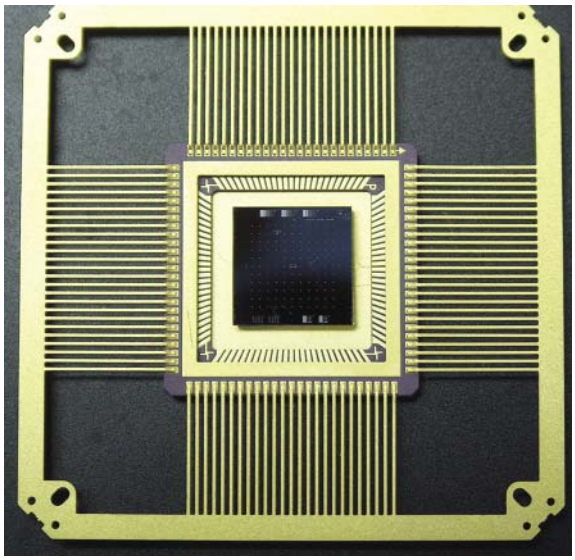
- Low cost – Hundreds of dollars compared to hundreds of thousands of dollars for flow cytometry.
- Low sample volume – Only a few microliters required to run a complete evaluation
- Portability – The miniaturized device will be powered by a conventional Lithium-Ion battery
- High purity – No external particles involved
- High speed – Massively parallel identification and sorting
- Wide-spread accessibility – To research labs and medical facilities.

The MPCAS chip will be capable of capturing individual cells suspended in a conventionally labeled isotonic solution by trapping them in its (m x n) array of micro-wells. Through micro-fluidic channels in the chip, the cells of interest can quickly be transported through the chip for further biochemical processing, such as PCR or electrophoresis.



Above: Exploded view of a massively parallel analysis and sorting (MPAS) chip.

Below: A prototype device package.



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